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Prospective study for results of various modalities used in the management of paediatric both bone fracture forearm

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Abstract

Introduction: Dia-physeal fractures of both-bone forearm are common in pediatric age group. The standard management of these fractures remains conservative treatment with closed manipulation and immobilization with above-elbow plaster cast for 4–6 weeks.[1] Although the fracture unites readily, malunion is very common. Stiffness of joints and compartment syndrome are other complications of conservative management with plaster cast.[2] Other modalities of treatment have been proposed for the treatment of both-bone forearm fractures in children and adolescents such as closed reduction and K-wire fixation and open reduction with plate fixation

Aims and objectives

1. To evaluate the clinico-radiological status of the fracture.
2. To evaluate the functional outcome and possible complication

Material and method: This was a prospective study done from June 2 020- May 2021. The study includes 30 patients between 6-15 years with both bone fracture forearm attending the hospital within the duration of 12 months from June 2020 to May 2021 managed by close reduction with splint age and Open Reduction and Internal Fixation were included in study

Observation and result: Using Price et all Criteria 20 patient had excellent, 8 patient good, 2 patient fair outcome. Mean union time was 5.86 weeks with standard deviation of 0.63 weeks. In 75% cases union time was by 6 weeks and in 5 % cases (2) union time was delayed to beyond 7 weeks

Conclusion: CR and Splint age, Open reduction and internal fixation both have proved to be an excellent

procedure leading to union in all the cases of both bone forearm fracture

Keyword: TENS, Both bone forearm, Close reduction, Casting, radius ulna.

Introduction

Forearm fractures are relatively common injuries, accounting for 41.1% of the fractures in the paediatric population[1]. Dia-physeal radial and ulnar fractures make up to approximately one-eighth of the total forearm fractures[2,3]. The majority of these fractures can be treated well with closed reduction and cast immobilization due to the unique property of the growth potential of the immature bones. Perfect anatomical reduction is not always necessary since remodeling may correct any residual deformity.[4,5] Although, there is a subset of patients in whom surgical intervention is indicated[6]. Angulation has been shown to affect the range of pronation and supination of the forearm.[3,7,8,9] Loss of pronation and supination is also proportional to the degree of rotational malunion[10]. Some authors have advocated surgical management of displaced forearm fractures in children who have an open physics and growing bone using plating[7,11,12,13],intramedullary rod[14,15,16], pins, plasters[17] and external fixation[18]. The most common indications for surgery are failure of closed reduction, open fractures, and fracture instability which if left untreated will lead to malunion and compromised function of upper extremity[18,19.] Children aged >10 years do not remodel as predictably; thus, reduction standards are less uniform. Operative intervention has been recommended in prior studies for angulation >10°, malrotation, and displacement >50%.[11,16] ORIF with plates and screws disadvantages are large incisions with poor cosmesis, more soft tissue dissection, higher incidence of infections and difficult removal. As far as intramedullary fixation (Kirschner wires, Steinmann pin and rush nails) but they have their own disadvantages such as Kirschner wires and Rush nails are rigid and difficult to insert through the metaphysis of bone. Because these disadvantages, flexible intramedullary nail (Titanium Elastic Nailing System) were devised to overcome this problem which produces a three-point fixation.

Materials and Methods

This was a prospective study done from June 2020-May 2021. The study includes 30 patients with both bone fracture forearm in children attending the hospital within the duration of 12 months from June 2020 to May 2021 managed by close reduction with splint age and Open Reduction and Internal Fixation The approval of ethical committee and informed consent from all the patients regarding participation in this study was taken.

Patient between 6 and 15 yr with closed un-displaced and displaced only Dia-physeal fracture, unacceptable closed reduction were included. Following patient were excluded age beyond range of 6 to 15yr,greenstick fractures, open fractures, Monteggia and Galeazzi fracture-dislocation of the forearm .Patients were evaluated and assessed post-treatment, subsequently at 1 month, 2 months and 6 months.

Pre-operative assessment and planning: Detailed history was taken, noting mode and severity of injury, event and type of trauma to the tissues and detailed examination of affected extremity. All the required routine investigations and radiological examination (standard plain antero-posterior and lateral radiograph) was done. Fracture was classified on the basis of pattern. After pre anaesthetic checkup, the patient was planned for surgery at the earliest.

Operative technique

In operation theatre under general anaesthesia, patient in supine position and all aseptic precautions, cleaning, painting, and draping is done. Hand is covered with a hand towel or glove. Limb is exsanguinated and tourniquet is inflated.

For plating The Henry (anterior) or Thompson (posterior) approaches to the radial shaft and the direct (medial) approach to the ulnar shaft. The fracture was secured with close appropriate implants and close reduction f/b splint age. The various implants used during fixation were(a) TENS (b) K-wires(c)1/3 tubular plate (d) Plaster of paris slab /cast

Post-operative management: 1st post-operative wound assessment done on day 2 and subsequently on day 6. If suture line was clean, suture removal was done 10-12 days after operation under strict aseptic conditions. Light weight lifting(with both limbs and even one limb) was allowed after osseous union was seen radiologically (approx. 4-8 weeks postoperatively).

Follow up and evaluation: Patient was followed up at 1 month, 2 months and 6 months. Check x ray was taken at every visit and patient was clinically and radiologically assessed for fracture union, functional outcome and complications.

Price Et Al criteria (at 6 months)

Outcome	Symptoms	Loss of forearm rotation
Excellent	No complaints with strenuous activity	< 15°
Good	Mild complaint with strenuous activity	15° - 30°
Fair	Mild complaint with daily activities	31° - 90°
Poor	All other results	> 90°

Statistical analysis

Qualitative variables/Categorical variables were presented in number and percentage (%) and Quantitative variables/continuous variables were presented as mean ± SD. P-value ≤0.05 is taken as a level of statistical significance. The data were analysed by SPSS (statistical package for social sciences) Statistical software version 17.0.

Observations and Result

The present study consisted of 30 patients with both bone fracture forearm in children which were managed by conservatively (CR with Splint age) and open reduction and internal fixation in Department of Orthopedics, Govt. Medical college and Hospital, Ratlam between June 2020 to May 2021.The following observations were made:

Age distribution

All the patients of 6-15 years age were included in this study. The mean age of the patients was 9.2 years (standard deviation 2.54years).

Age	Frequency	Percentage
6-8 years	10	33%
9-12 years	14	47%
13-15 years	06	20%
Gender		
Male	20	67%
Female	10	33%
Mode of trauma		
Fall during playing	24	80%
Quarrel	4	13%
RTA	2	7%
Side Affected		
Right	22	73%
Left	8	27%
Delay in		

presentation		
Within 3days	28	93%
>3 days	2	7%
Trial of reduction		
Once	26	87%
Twice	4	13%

Type of fractures: In this study, the fractures have been classified on the basis of level of fracture.

OA/OTA fracture classification	Frequency	**Percentage**
22A3	26	87%
22B3	2	7%
22C1	1	3%
22C2	1	3%

Modalities of treatment

In this study, various modalities of treatment were used on random basis.

Treatment modality	Frequency	**Percentage**
CR + Splint age	22	73%
TENS	3	10%
K –Wire	3	10%
1/3 Tubular Plate	2	7%

Time of fracture union

The union of fracture was assessed radiologically and clinically criteria. In the present series mean union time was 5.86 weeks with standard deviation of 0.63 weeks. In 75% cases union time was by 6 weeks and in 5 % cases (2) union time was delayed to beyond 7 weeks.

Time of fracture union (in weeks)	Frequency	Percentage
Within 5 weeks	4	13%
By 6 weeks	24	80%
>7weeks	2	7%

Complications: One patient had superficial infection that subsided with antibiotics

Final follow up (based on Price et al criteria)

Outcome	**Frequency**	**Percentage**
Excellent	20	67%
Good	8	27%
Fair	2	6%
Poor	-	-

Discussion

The purpose of the present study was to study the various modalities used in treatment of both bone forearm fracture and assess functional outcome following treatment.

Age Distribution

We found in our study that both bone forearm fractures are more common in 9 -12years age (47%). Mean age was found to be 9.2 years (S.D. 2.54years).

Garg NK et al [20]in a study of 21 patients found mean age to be 12.8 years.

Mathew L et al[21] found the mean age to be 9.6 years in a study of 50 patients.

Vishwanath C et al[22] in a study of 50 patients noted a mean age of 11.25 years.

Haris K et al [23]in a study of 27 patients found mean age to be 10.2years.

Sex Distribution

Males were predominantly affected in our series (67%), while females (33%). High incidence of males involved in fall during playing may be reason for male predominance.

Garg NK et al [20]in his study, found 66.6% incidence in males compared to females

Vishwanath C et al[22] in his study, found incidence of 70% in males compared to females

Haris K et al [23]in his study, found incidence of 70.37% in males compared to females

Sex distribution in our study showed a male preponderance compared to other studies.

Laterality: In the present study, right side (73%) was more commonly affected than left.

Vishwanath C et al[22] in his study on 50 patients showed 56% incidence on the right side.

Dominant Hand

In the present study, dominant side (85%) was more commonly affected than non-dominant side and dominant side is right side (73%)

Fracture Union

In our study, average union time (clinically and radiologically assessed) was 6 weeks with a standard deviation of 1.0 weeks. 23% of fractures (7) united within 5 weeks, 70% of fractures (21) united by 6 weeks while 7% of fracture (2) had united beyond 7 weeks.

Modality of Treatment and Results

Of the 30 both bone forearm fracture in children, 22 patient (73%) were treated with close reduction f/b splint age and Of these 2 patients had “good” result, 5 patients had “fair” result and 15 patient had “poor” result at 1 month. By the 2 months , 3 patients had “excellent” result, 4 patients had “good” result, 15 patients had “fair” result, 6 patient had “poor” result at 1 month which is improved 16 patients had “excellent” result, 4 patients had “good” result, 2 patients had “fair” result 3 months.

3 patients (10%) were treated by K-wire. All patients had poor result at 1 month. Of these 1 patient had “fair” result and 2 patients had “poor” result at 2 months which is improved to 2 patients had “excellent” result, 1 patient had “good” result at 3 months.

3 patients (10%) were treated by TENS. All patients had poor result at 1 month. Of these 1 patient had “fair” result and 2 patients had “poor” result at 2 months which is improved to 2 patients had “excellent” result, 1 patient had “good” results at 3 months.

2 patient (7%) were treated by 1/3 T.P. Of these 1 patient had “fair” results and 1 patient had “poor” results at 1 month. Of these 1 patient had “fair” results and 1 patient had “excellent” results at 2 months which is improved to 2 patients had “excellent” result at 3 months.

Conclusion

From this prospective study we conclude that both bone forearm fracture in children are commonly seen in active young child and are commonly seen as a result of fall during playing. CR and Splint age, Open reduction and Internal fixation both have proved to be an excellent procedure leading to union in all the cases

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